ANNUAL REPORT
to the
GOVERNMENTS
of
THE UNITED STATES
and
CANADA

COLUMBIA RIVER TREATY
PERMANENT ENGINEERING BOARD
Washington, D. C. Ottawa, Ontario
30. SEPTEMBER 1969

COLUMBIA RIVER TREATY PERMANENT ENGINEERING BOARD

CANADA · UNITED STATES

CANADIAN SECTION
G. M. MacNABB, Chairman
A. F. PAGET, Member

UNITED STATES SECTION
W. E. JOHNSON, Chairman
M. D. DUBROW, Member

31 December 1969

The Honourable William P. Rogers
The Secretary of State
Washington, D.C.

The Honourable J. J. Greene
Minister of Energy, Mines and Resources
Ottawa, Ontario

Gentlemen:

Reference is made to the Treaty between the United States of America and Canada, relating to co-operative development of the water resources of the Columbia River basin, signed at Washington, D.C., on 17 January 1961.

In accordance with the provisions of Article XV paragraph 2(e), there is submitted herewith the fifth Annual Report, dated 30 September 1969, of the Permanent Engineering Board.

The report sets forth results achieved and benefits produced under the Treaty for the period from 1 October 1968 to 30 September 1969.

Respectfully submitted:

For the United States

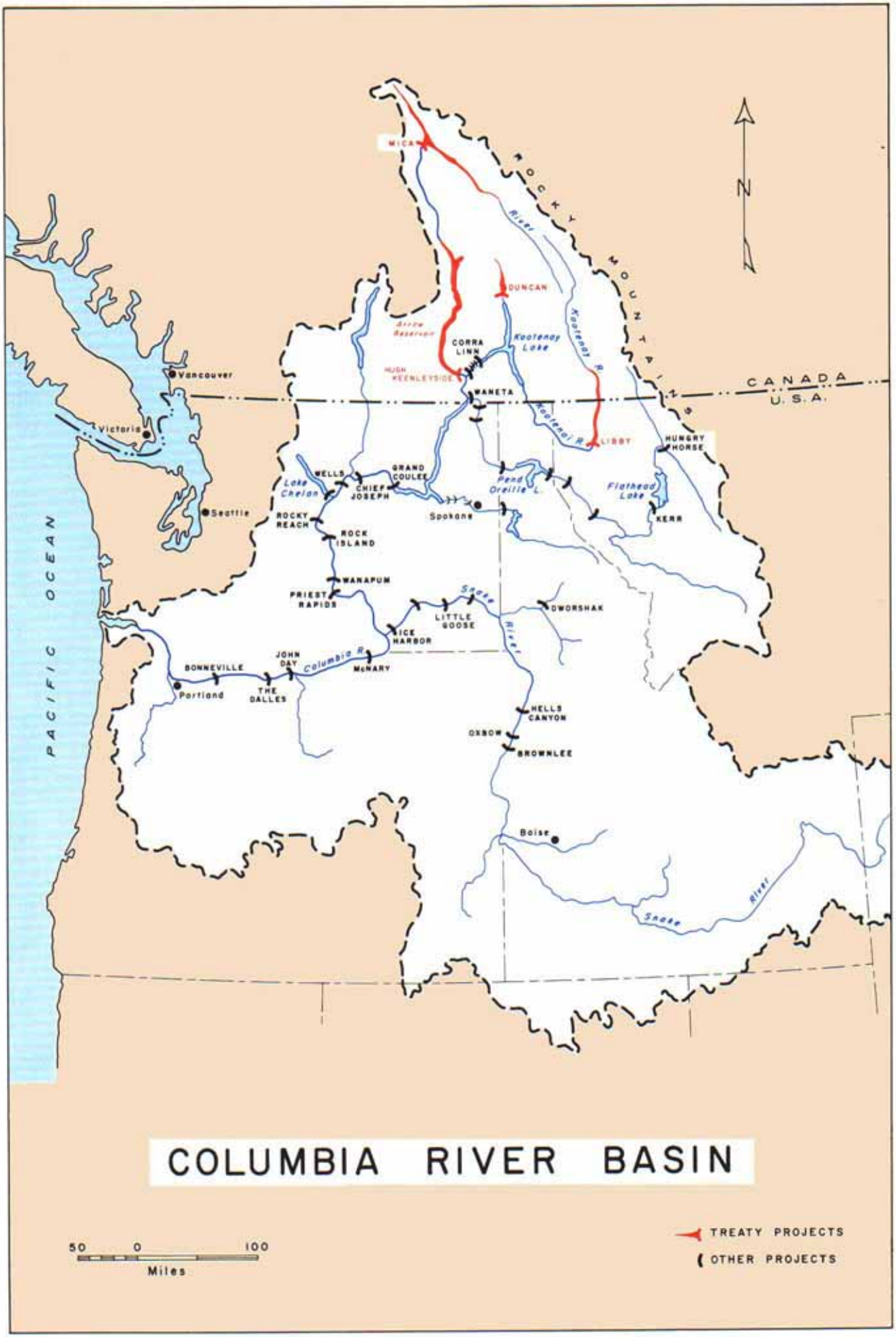
Wendell E. Johnson
Wendell E. Johnson, Chairman

Morgan D. Dubrow
Morgan D. Dubrow

For Canada

G.M. MacNabb
G.M. MacNabb, Chairman

A.F. Paget
A.F. Paget



COLUMBIA RIVER BASIN

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to the
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PERMANENT ENGINEERING BOARD

Washington, D.C. **Ottawa, Canada**

30 September 1969

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Photographs for the Arrow and Mica Projects were supplied by the British Columbia Hydro and Power Authority.

Photographs for the Libby Project were supplied by the Corps of Engineers, U.S. Army.

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SUMMARY

The fifth Annual Report of the Permanent Engineering Board is submitted to the Governments of the United States and Canada in compliance with Article XV of the Columbia River Treaty of 17 January 1961. Project construction, progress of Entity studies, operation of the Arrow and Duncan reservoirs, and the resulting benefits are described.

One Board meeting and one meeting of the Board with the Entities were held during the reporting period. The Board also inspected the Mica and Libby projects during the month of August 1969. Work on both projects is on schedule.

The Hugh Keenleyside Dam and Arrow reservoir were declared operational on 10 October 1968 well in advance of the date required by Treaty. The flood control payment of $52,100,000 in United States funds ($55,909,812.50 in Canadian funds) was paid to Canada on the date full operation was commenced.

The Arrow and Duncan reservoirs have been operated in accordance with the objectives of the Treaty, the terms of the special operating program approved by the two governments, the interim flood control plan, and the hydroelectric operating plans for Canadian storage which have been forwarded to the two governments for approval by an exchange of notes. In recognition of the advanced partial operation of the Arrow storage, Canada, during this report year, received 390,215,000 kilowatt hours of energy from the United States delivered at rates up to a maximum of 200,000 kilowatts.

Studies pertaining to development of the hydrometeorological network, power and flood control operating plans, and the calculation of downstream power benefits are being continued by the Entities to ensure operation of the projects in accordance with the terms of the Treaty.

The Board concludes that the objectives of the Treaty are being met.

INTRODUCTION

The Columbia River Treaty, which provides for co-operative development of the water resources of the Columbia River basin, was signed in Washington, D.C. on 17 January 1961 by representatives of the United States and Canada. Article XV of the Treaty established a Permanent Engineering Board and specified that one of its duties would be to "make reports to Canada and the United States of America at least once a year of the results being achieved under the Treaty...".

This Annual Report, which covers the period 1 October 1968 to 30 September 1969, describes activities of the Board, progress being achieved by both countries under the terms of the Treaty, operation of the Treaty projects, and the resulting benefits. The report also states that, in the opinion of the Board, the objectives of the Treaty are being met. Summaries of the essential features of the Treaty and of the responsibilities of the Board and of the Entities are included.

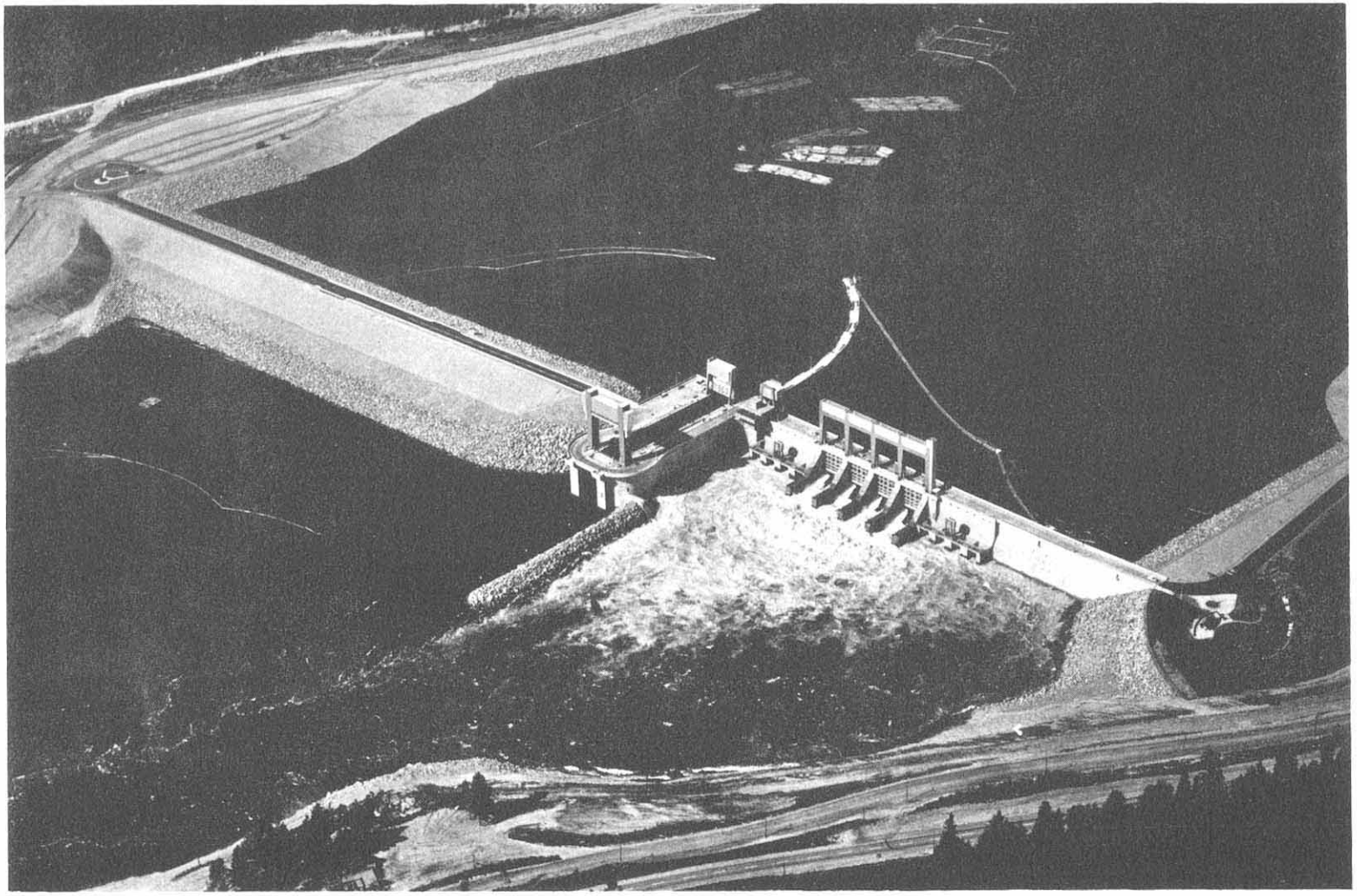
THE COLUMBIA RIVER TREATY

General

The Columbia River Treaty was signed in Washington, D. C. on 17 January 1961 and was ratified by the United States Senate in March of that year. In Canada ratification was delayed. Further negotiations between the two countries resulted in formal agreement by an exchange of notes on 22 January 1964 to a Protocol to the Treaty and to an Attachment Relating to Terms of Sale. The Treaty and related documents were approved by the Canadian Parliament in June 1964.

The Canadian Entitlement Purchase Agreement was signed on 13 August 1964. Under the terms of this agreement Canada's share of downstream power benefits resulting from the first thirty years of scheduled operation of each of the storage projects was sold to a group of electric utilities in the United States known as the Columbia Storage Power Exchange.

On 16 September 1964 the Treaty and Protocol were formally ratified by an exchange of notes between the two governments. The sum of $253.9 million (U. S. funds) was delivered to the Canadian representatives as payment in advance for the Canadian entitlement to downstream power benefits during the period of the Purchase Agreement. On the same date at a ceremony at the Peace Arch Park on the International Boundary the Treaty and its Protocol were proclaimed by President Johnson, Prime Minister Pearson, and Premier Bennett of British Columbia.



HUGH KEENLEYSIDE DAM — Columbia River, British Columbia

The dam and Arrow reservoir during the 1969 freshet.

Features of the Treaty and Related Documents

The essential features of the Treaty are as follows:

(a) Canada will provide 15.5 million acre-feet of usable storage by constructing dams near Mica Creek, the outlet of Arrow Lakes, and Duncan Lake, in British Columbia.

(b) The United States will maintain and operate hydroelectric power facilities included in the base system and any new main-stem projects to make the most effective use of improved stream flow resulting from operation of the Canadian storage. Canada will operate the storage in accordance with procedures and operating plans specified in the Treaty.

(c) The United States and Canada will share equally the additional power generated in the United States as a result of river regulation by upstream storage in Canada.

(d) On commencement of the respective storage operations the United States will make payments to Canada totalling $64.4 million (U.S. funds) for flood control provided by Canada.

(e) The United States has the option of constructing a dam on the Kootenai River near Libby, Montana. The Libby reservoir would extend some 42 miles into Canada and Canada would make the necessary Canadian land available for flooding.

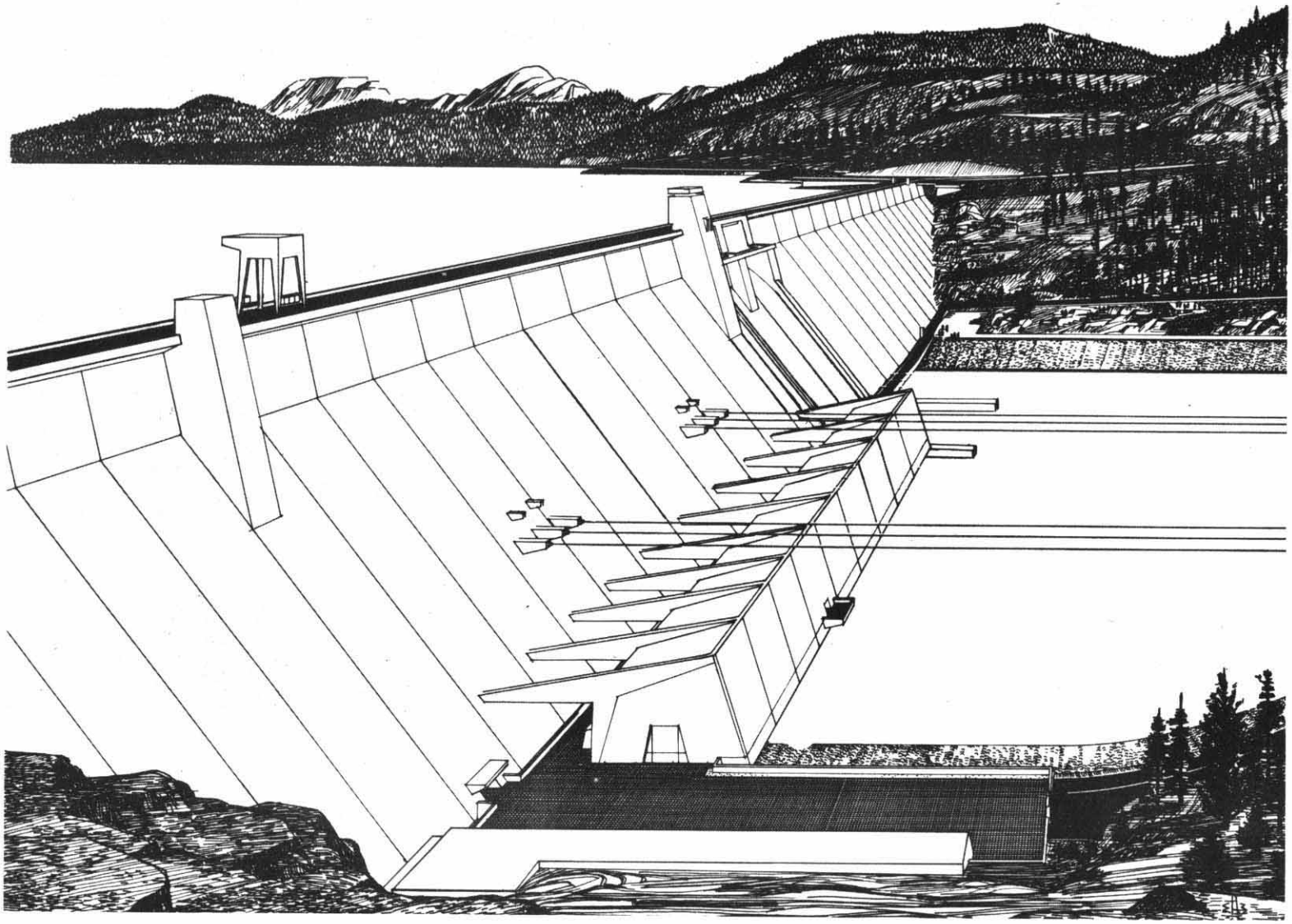
(f) Canada has the option of making specific diversions of the Kootenay River.

(g) Differences arising under the Treaty which cannot be resolved by the two countries may be referred by either to the International Joint Commission or to arbitration by an appropriate tribunal as specified by the Treaty.

(h) The Treaty shall remain in force for at least 60 years from its date of ratification, 16 September 1964.

The Protocol of January 1964 amplified and clarified certain terms of the Columbia River Treaty. The Attachment Relating to Terms of Sale signed on the same date established agreement that under certain terms Canada would sell in the United States its entitlement to downstream power benefits for a 30-year period. The Canadian Entitlement Purchase Agreement of 13 August 1964 provided that the Treaty storages would be operative for power purposes on the following dates:

Duncan storage	1 April 1968
Arrow storage	1 April 1969
Mica storage	1 April 1973



LIBBY PROJECT

Kootenai River, Montana

Artist's conception of dam and powerhouse.

PERMANENT ENGINEERING BOARD

General

Article XV of the Columbia River Treaty established a Permanent Engineering Board consisting of two members to be appointed by Canada and two members by the United States. Appointments to the Board were to be made within three months of the date of ratification. The duties and responsibilities of the Board were also stipulated in the Treaty and related documents.

Establishment of the Board

Pursuant to Executive Order No. 11177 dated 16 September 1964 the Secretary of the Army and the Secretary of the Interior on 7 December 1964 appointed two members and two alternate members to form the United States Section of the Permanent Engineering Board. The members of the Canadian Section of the Board were appointed by Order in Council P.C. 1964-1671 dated 29 October 1964. Each member was authorized to appoint an alternate member. On 11 December 1964 the two governments announced the composition of the Board.

The names of the Board members, alternate members and secretaries are shown in Appendix A. It is noted that Mr. Verle Farrow has replaced Mr. John W. Roche as Secretary of the United States Section of the Board.

MICA PROJECT - 14 cubic yard loader filling 120 ton belly-dump unit. September 1969.

Duties and Responsibilities of the Board

The general duties and responsibilities of the Board to the governments, as set forth in the Treaty and related documents, include:

(a) assembling records of the flows of the Columbia River and the Kootenay River at the Canada-United States of America boundary;

(b) reporting to Canada and the United States of America whenever there is substantial deviation from the hydroelectric and flood control operating plans and if appropriate including in the report recommendations for remedial action and compensatory adjustments;

(c) assisting in reconciling differences concerning technical or operational matters that may arise between the entities;

(d) making periodic inspections and requiring reports as necessary from the entities with a view to ensuring that the objectives of the Treaty are being met;

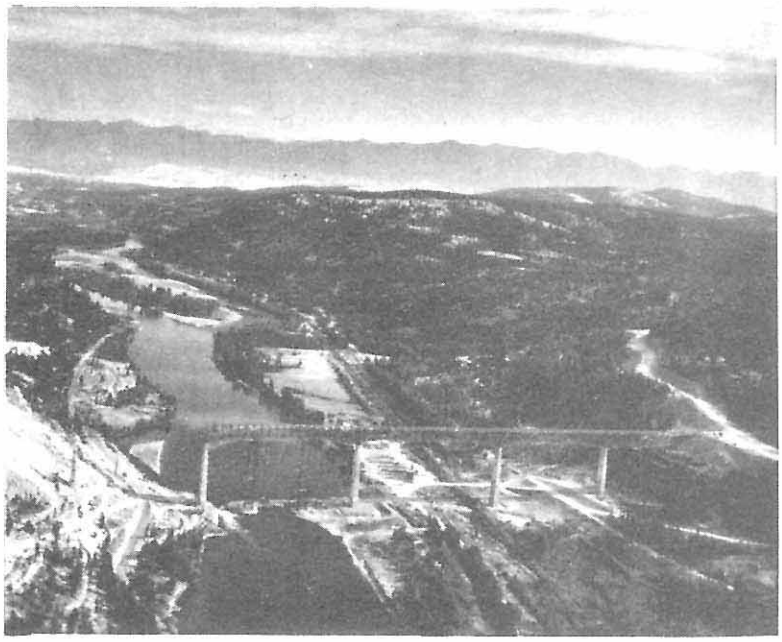
(e) making reports to Canada and the United States of America at least once a year of the results being achieved under the Treaty and making special reports concerning any matter which it considers should be brought to their attention;

(f) investigating and reporting with respect to any other matter coming within the scope of the Treaty at the request of either Canada or the United States of America;

(g) consulting with the entities in the establishment and operation of a hydrometeorological system as required by Annex A of the Treaty.

RESERVOIR BRIDGE

Libby Project.
Looking north with
Montana State Highway 37
relocation at right.
September 1969.



ENTITIES

General

Article XIV(1) of the Treaty provides for the designation by Canada and the United States of entities which are empowered and charged with the duty of formulating and executing the operating arrangements necessary to implement the Treaty. Provision is made for either government to designate one or more entities. The powers and duties of the entities are specified in the Treaty and related documents.

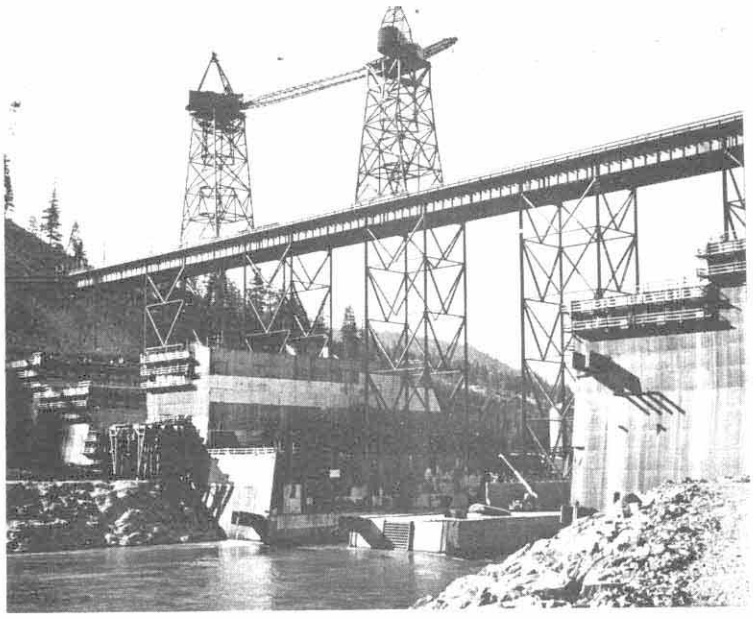
Establishment of the Entities

Executive Order No. 11177, previously referred to, designated the Administrator of the Bonneville Power Administration, Department of the Interior, and the Division Engineer, North Pacific Division, Corps of Engineers, Department of the Army, as the United States Entity with the Administrator to serve as Chairman. Order in Council P.C. 1964-1407 dated 4 September 1964 designated the British Columbia Hydro and Power Authority as the Canadian Entity for the purposes of the Treaty.

The names of the members of the two entities are shown in Appendix B. It is noted that Brigadier General Roy S. Kelley has replaced Brigadier General Elmer P. Yates as member of the United States Entity. It is also noted that the Honourable R.G. Williston has replaced Dr. H.L. Keenleyside as Chairman of the Canadian Entity.

LIBBY PROJECT

Diversion through low monoliths near left bank. July 1969.



Powers and Duties of the Entities

In addition to the powers and duties specified elsewhere in the Treaty and related documents the Treaty requires that the entities be responsible for:

(a) co-ordination of plans and exchange of information relating to facilities to be used in producing and obtaining the benefits contemplated by the Treaty,

(b) calculation of and arrangements for delivery of hydroelectric power to which Canada is entitled for providing flood control,

(c) calculation of the amounts payable to the United States of America for standby transmission services,

(d) consultation on requests for variations made pursuant to Articles XII(5) and XIII(6),

(e) the establishment and operation of a hydrometeorological system as required by Annex A,

(f) assisting and co-operating with the Permanent Engineering Board in the discharge of its functions,

(g) periodic calculation of accounts,

(h) preparation of the hydroelectric operating plans and the flood control operating plans for the Canadian storage together with determination of the downstream power benefits to which Canada is entitled,

(i) preparation of proposals to implement Article VIII and carrying out any disposal authorized or exchange provided for therein,

(j) making appropriate arrangements for delivery to Canada of the downstream power benefits to which Canada is entitled including such matters as load factors for delivery, times and points of delivery, and calculation of transmission loss,

(k) preparation and implementation of detailed operating plans that may produce results more advantageous to both countries than those that would arise from operation under the plans referred to in Annexes A and B.

Articles XIV(4) of the Treaty provides that the two governments may, by an exchange of notes, empower or charge the entities with any other matter coming within the scope of the Treaty.

ACTIVITIES OF THE BOARD

Meetings

A meeting of the Board was held in Victoria, British Columbia on 7 May 1969 to review progress. A meeting was also held with the Entities on the same day to review and discuss Entity studies and general progress under the Treaty.

Field Inspections

On 26 and 27 August 1969 the Board visited the Mica and Libby projects to assess construction progress.

Reports Received

The Board received three reports indicating construction progress of the Canadian Treaty projects from the Canadian Entity and semi-annual reports on construction progress of the Libby project from the United States Entity.

Semi-annual progress reports were received from the Entities on their studies relating to the hydrometeorological network, power and flood control operating plans, and calculation of downstream benefits, and on operation of the Treaty projects. The Board also received a copy of the Entities' annual report:

- Report of Columbia River Treaty Canadian and United States Entities for the period 1 October 1967 to 30 September 1968.

MICA PROJECT - Construction activity on earth fill dam. September 1969.

During the report year the Entities provided the Board with the following documents and with a copy of their signed agreement on each document:

- Interim Flood Control Operating Plan for Duncan and Arrow Reservoirs

- Hydroelectric Operating Plans for Canadian Storage - Operating Years 1969-70 through 1974-75.

The Entities also provided the Board with a letter representing Entity agreement on adjustments to operation of Duncan and Arrow Reservoirs under the agreed operating plans.

At the end of the report year the Entities supplied the Board with the following documents:

- Agreement on Recommendation No. 5 for Hydrometeorological Network

- Hydrometeorological Committee Recommendation No. 6

- Agreement on Hydroelectric Operating Plans for Canadian Storage During the Operating Years 1969-70 through 1974-75

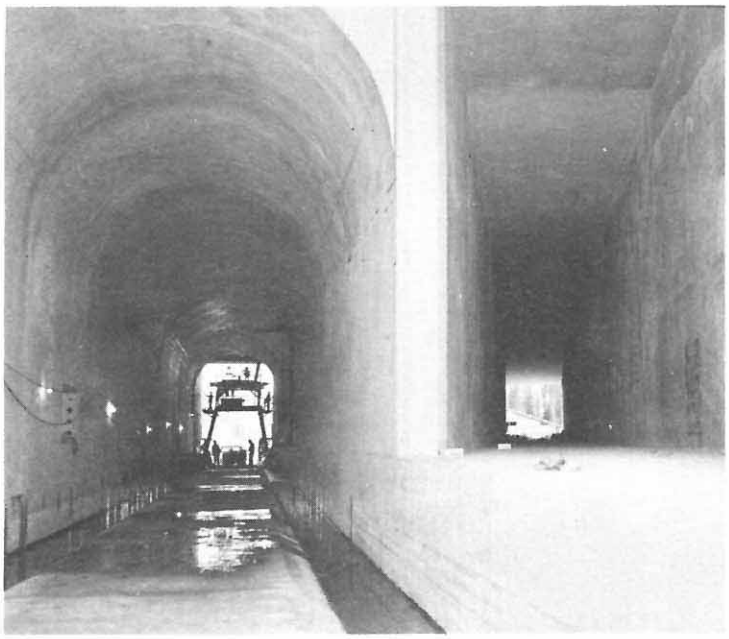
- Determination of Downstream Power Benefits Resulting from Canadian Storage for Operating Years 1969-70 through 1974-75 plus a copy of the Entities' signed agreement on this document

Report to Governments

The fourth Annual Report of the Board was submitted to the two governments on 31 December 1968.

RAILWAY TUNNEL

Libby Project.
North portal,
ventilating duct
at right.
July 1969.



PROGRESS

General

The results achieved under the terms of the Treaty include progress on construction of the Treaty projects and on studies regarding development of the hydrometeorological network, power and flood control operating plans, and the annual calculation of downstream power benefits.

Duncan Dam was placed in operation on 31 July 1967. The Arrow project was declared operational on 10 October 1968, well in advance of the Treaty requirements. Both projects produced power and flood control benefits during the report year. The locations of the Treaty projects are shown on Plate 1.

At a dedication ceremony on 9 June 1969 the Arrow Dam was named the Hugh Keenleyside Dam by the Honourable W.A.C. Bennett, Premier of British Columbia, in honour of the Chairman of the Canadian Entity. This dam is shown in the picture on page 3.

Construction Progress of the Treaty Projects

Mica Project

Mica dam, the largest of the Treaty projects, is scheduled by the Sales Agreement for initial operation on 1 April 1973.

MICA PROJECT Columbia River, British Columbia

The dam site showing diversion tunnel outlets, progress of the main fill, and rock excavation for the upper part of the spillway.

The general arrangement of structures for the Mica project is shown on Plate 2. The main dam will have a nearly vertical impervious core supported between zones of coarser material. The two 45-foot diameter diversion tunnels are located in the left abutment. Spillway facilities and control works to provide regulated discharges from storage will also be constructed in the left abutment and power facilities will be located underground in the right abutment.

Construction of the dam is on schedule. During the previous report year the Columbia River was diverted through the two tunnels. During this report year excavation of the river-bed overburden was completed and the main dam fill has been placed to above cofferdam level. Rock excavation is continuing on both

MICA PROJECT

Spillway approach channel with control works and excavation for chute spillway in foreground. September 1969.

abutments. General progress of the main fill is shown on Plate 3 and in the picture on page 17. Rock excavation of the spillway approach channel is complete and excavation of the spillway chute is in progress.

Construction of haul roads along both sides of the Columbia River is complete. The project area is shown on Plate 4. Selected clearing is being carried out and possible landslide areas around the reservoir are being investigated.

Libby Project in the United States

Libby dam is the fourth and last of the Treaty projects to be placed under construction. Initial phases, including highway and railroad relocations, were commenced in June 1966. In accordance with Article XII of the Treaty the dam is to be operational by 30 June 1973.

The general arrangement of the structures is shown on Plate 5, and the reservoir area and the required highway and railroad relocations are depicted on Plate 6. The concrete gravity dam will be capable of storing water up to elevation 2,459 feet, and the reservoir, with a total length of 90 miles, will extend some 42 miles into British Columbia. Procurement and preparation of the land required for the portion of the reservoir in Canada is, in accordance with the terms of the Treaty, the obligation of the Canadian Government. By subsequent agreement between Canada and the Province of British Columbia on 8 July 1963, British Columbia undertook responsibility for these flowage costs in Canada.

LIBBY PROJECT Kootenai River, Montana

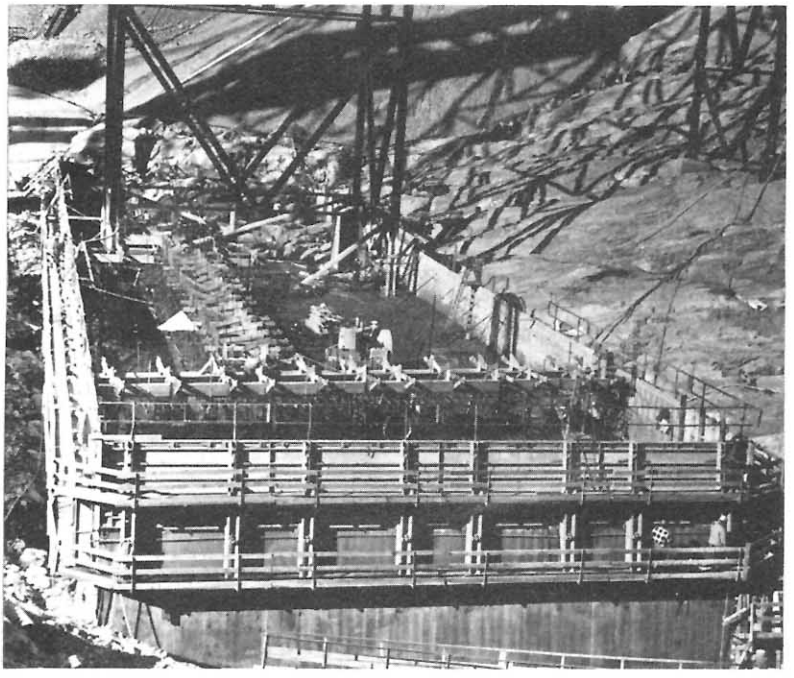
Aerial view from downstream showing progress; power section of the dam is inside the second stage cofferdam. July 1969.

The dam will consist of non-overflow monoliths, powerhouse intake and spillway monoliths. The spillway monoliths will contain two radial-type crest gates, and the outlet works will be combined into the same section to utilize a common stilling basin. A roadway and sidewalks will be provided over the dam. The powerhouse will provide space for eight generating units for a total installed capacity of 840,000 kw. Initial installation will be 420,000 kw.

The dam construction is on schedule. First stage concrete placement has been completed and the river has been diverted through low monoliths 33 and 35. Concrete placement is progressing within the second stage cofferdam on the right bank. Construction of highway and bridge relocations and reservoir clearing in the Montana section of the reservoir are progressing on schedule to meet the partial pool raise to elevation 2405 by May 1972.

LIBBY PROJECT

Monolith at right bank with forms for drainage gallery. July 1969.



Two grading contracts for the Great Northern Railroad relocation have been completed and the two remaining grading contracts are scheduled for completion this construction season. The tunnel contract is near completion and installation of the tunnel ventilation system is well advanced. The contract for track laying, signals and communications system has been awarded and is scheduled to be completed by 1 September 1970. The contract for station facilities is scheduled to be awarded during the fall of 1969, and railroad traffic will be moved from the existing reservoir route onto the new line by 1 November 1970.

Libby Project in Canada

Within the pondage area in Canada, a total of 9,080 acres will be cleared. This program is proceeding on schedule and acquisition of property is well in hand.

The relocation of provincial highway routes involves the construction of 22 miles of roadworks and five bridges. A contract has been awarded for construction of the approaches to the Wardner highway bridge, one of the two reservoir crossings in Canada. The other reservoir crossing, shown on Plate 6, will form part of the future southern Trans-Provincial highway.

The existing rail crossing at Wardner will be removed and a new bridge constructed north of the reservoir near Fort Steele. Sections of the Canadian Pacific Railway track will be abandoned.

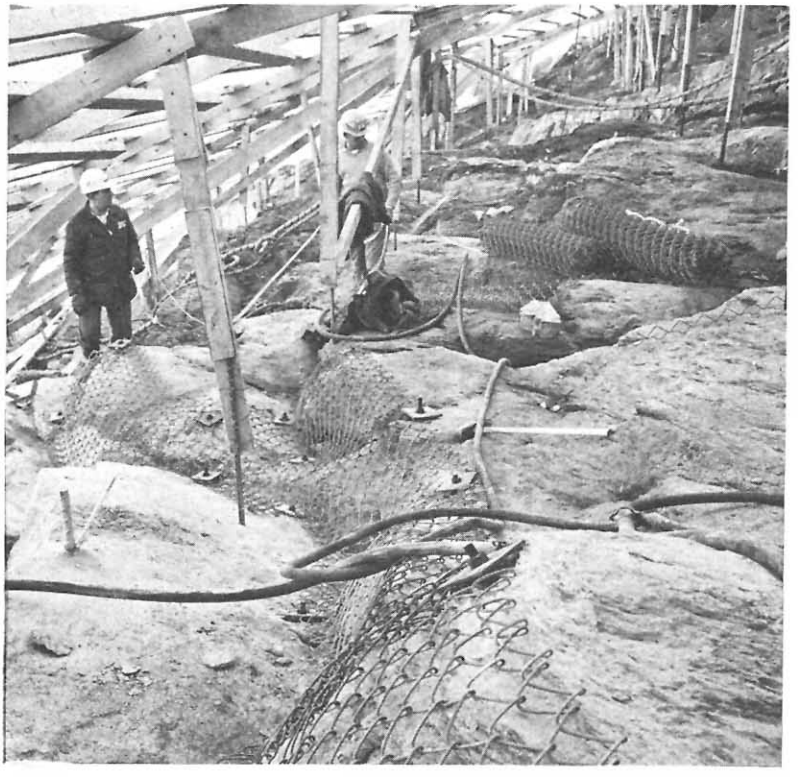
Studies are proceeding to evaluate the anticipated effects of the operation of the reservoir on the shoreline. Results of these studies guide the Provincial Government in its program of land acquisition.

Hydrometeorological Network

One of the responsibilities assigned to the Entities by the Treaty is the establishment and operation , in consultation with the Permanent Engineering Board, of a hydrometeorological system to obtain data for detailed programming of flood control and power operation. This system will include snow courses, precipitation stations and streamflow gauges.

In the preceding report year the Entities, with the concurrence of the Board, adopted a document which defines the Columbia River Treaty Hydrometeorological System Network and sets forth a method of classifying facilities into those required as part of the Treaty System and those of value as Supporting Facilities. The Entities provided the Board with copies of their agreed classification of the facilities covered by Hydrometeorological Recommendations 1, 2, 3, and 4. At the end of the preceding report year the Entities formed a Columbia River Treaty Hydrometeorological Committee.

In this report year the Entities, with the concurrence of the Board, adopted Hydrometeorological Recommendation 5 which lists the requirements for streamflow and reservoir gauges classified as Treaty facilities in the United States. At the end of the report year the Entities supplied the Board with a recommendation outlining an interim plan for exchange of hydrometeorological data. The Board is considering this recommendation.



MICA PROJECT

"Greenhouse" protects right abutment for guniting in winter. February 1969.

Power Operating Plans

The Treaty and related documents provide that before any of the Canadian storage becomes operative the Entities will agree on operating plans and downstream power benefits for each year until the total of 15,500,000 acre-feet of storage in Canada becomes operative. In addition, based on the terms of the Treaty, the Entities are to agree annually on operating plans and on the resulting downstream power benefits for the sixth succeeding year of operation.

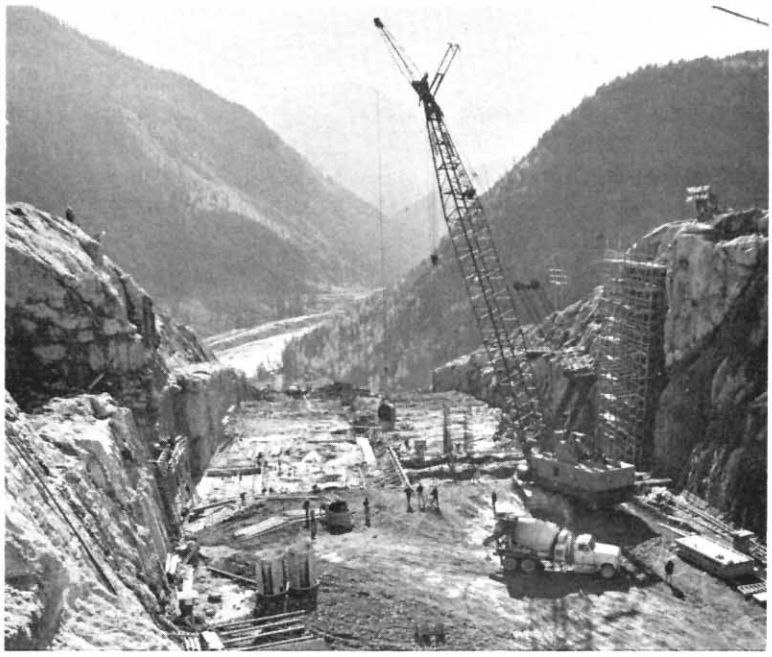
In the previous report year the Entities agreed on a special operating program for Canadian storage which covered arrangements for storage operation and downstream benefits during the period 1 April 1968 through 30 June 1969. This program governed operation of the Duncan and Arrow projects until 30 June 1969. The program and the exchange of notes indicating approval of the two governments are included as Appendix D. The program was supplemented later in the year when the Entities agreed on a special operating plan for Canadian storage for the period 1 August 1968 through 31 July 1969. At the end of the report year the Entities formed a Columbia River Treaty Operating Committee.

In this report year the Entities agreed on hydroelectric operating plans for Canadian storage for the operating years 1969-70 through 1974-75. The operating plans were reviewed by the Board and have been forwarded to the two governments for approval by an exchange of notes.

Detailed operating plans for Canadian storage are being developed by the Entities for the operating year ending 31 July 1970.

MICA PROJECT

Top end of chute spillway and start of control works. October 1969.



Annual Calculation of Downstream Benefits

The general requirements for determination of assured operating plans and downstream power benefits are summarized in the first paragraph of the preceding section.

In this report year the Board completed its review of the Entities' document describing procedures for the determination of downstream power benefits from Canadian storage. The Entities completed their evaluation of downstream power benefits in accordance with procedures outlined in the Treaty and provided the Board with a copy of their agreed document outlining downstream power benefits resulting from Canadian storage for the operating years 1969-70 through 1974-75. The Board is reviewing this document.

Flood Control Operating Plans

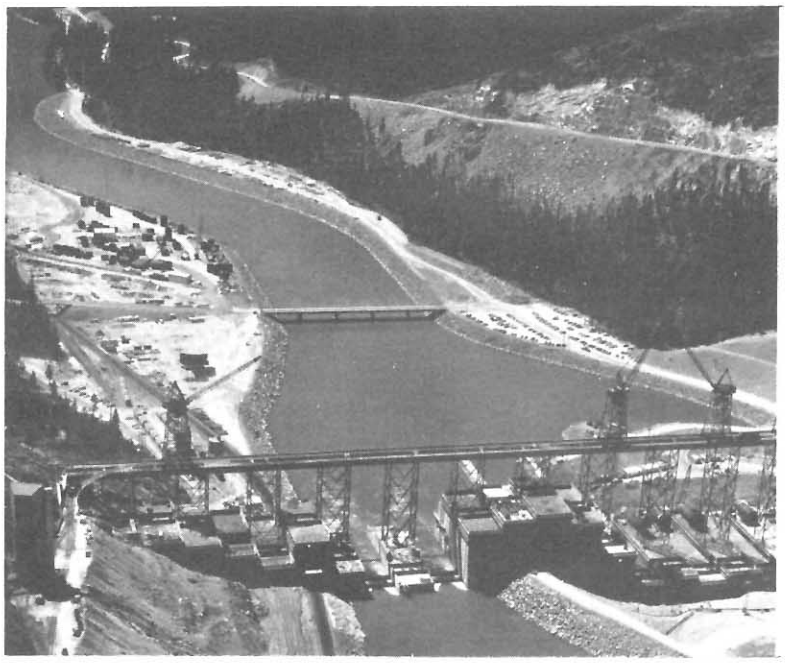
The Treaty provides that Canadian storage reservoirs will be operated by the Canadian Entity in accordance with operating plans designed to minimize flood damage in the United States and Canada.

During the report year the Entities reached agreement on an interim flood control plan for the Duncan and Arrow Reservoirs which will govern flood control operations until the next project under the Treaty becomes operational. The Entities provided the Board with a copy of the plan.

The Entities are studying the effects of discharges from the Libby project on the existing International Joint Commission Order for regulation of Kootenay Lake.

LIBBY PROJECT

Improved channel downstream from the dam.
July 1969.



Flow Records

Article XV(2)(a) of the Treaty specified that the Permanent Engineering Board shall assemble records of flows of the Columbia and Kootenay Rivers at the Canada - United States of America boundary. Actual recorded flows for the Kootenai River at Porthill, Idaho, and for the Columbia River at Birchbank, British Columbia, (see Plate 1) are tabulated in Appendix C for this report year.

ARROW RESERVOIR

Big Eddy dyke and City of Revelstoke at head of the reservoir. May 1969.

OPERATION

General

At the end of the preceding report year the Entities established the Columbia River Treaty Operating Committee. This committee is responsible for developing operating plans for the Treaty storages and for directing operation of these storages on a continuing basis in accordance with the terms of the Entity agreements. During this report year the Treaty storages were operated in accordance with committee directives normally issued on a weekly basis.

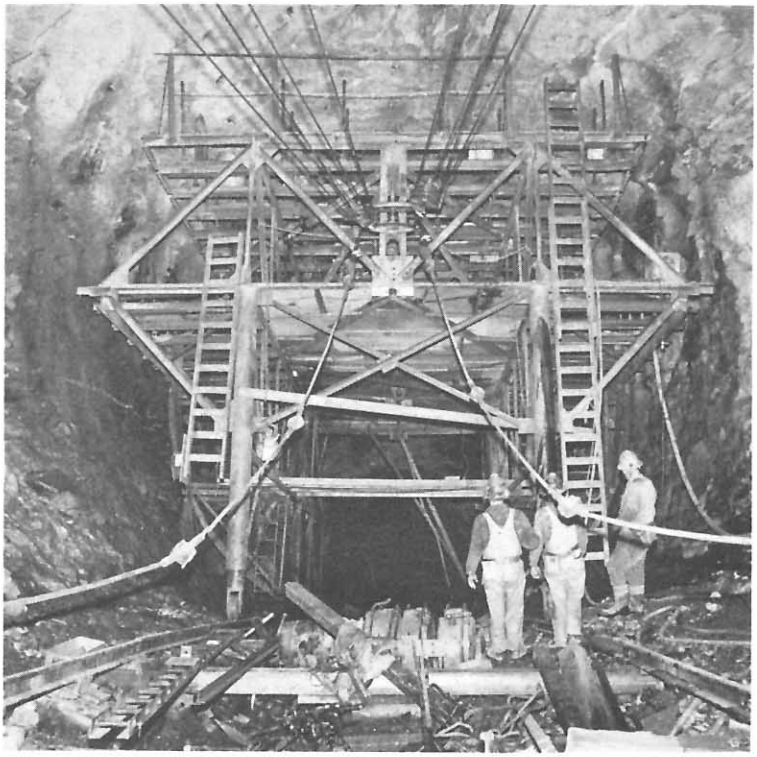
Power Operation

Treaty storage in Canada was operated for hydroelectric power by the Canadian Entity during the report year in accordance with the special operating plan for Canadian storage during the period 1 August 1968 through 31 July 1969 and the hydroelectric operating plan for Canadian storage for the operating year 1969-1970. Some adjustments were made to operation under the special operating plan to facilitate construction of the third powerhouse at Grand Coulee.

During the first part of the report year use of the Treaty storage was not required and release of storage from Duncan and Arrow reservoir did not commence until the first part of December.

MICA PROJECT

Drill Jumbo in low level outlet tunnel.
July 1969



Duncan reservoir was fully operational during the report year and provided about 1,270,000 acre-feet of reservoir storage to supplement natural streamflow by the end of the storage draft season. Arrow reservoir was partially operational at the beginning of the report year and provided about 2,100,000 acre-feet of reservoir storage. Both reservoirs filled completely during the 1969 freshet in a manner consistent with flood control and hydroelectric requirements.

Use of Treaty reservoir storage commenced in the first part of August 1969 because natural inflows were well below average. As a result both reservoirs were below their operating rule curves at the end of August. By the end of the report year inflows were about average and only the Arrow reservoir remained below the rule curve.

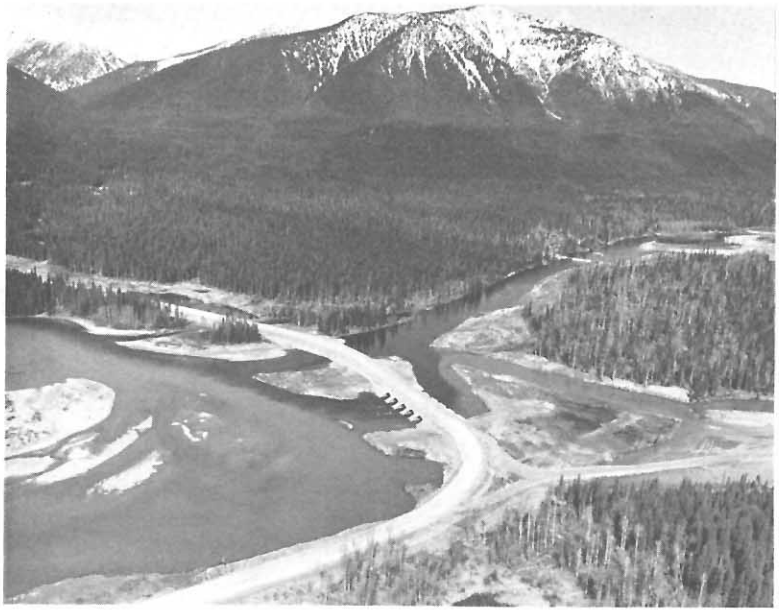
Flood Control Operation

The Entities agreed to operate Treaty storage for flood control during the 1969 freshet in accordance with the objectives of the document "Interim Flood Control Operating Plan for Duncan and Arrow Reservoirs". Duncan reservoir was operated in accordance with the stated procedures, but operation of Arrow reservoir was modified to suit construction requirements of the third powerhouse at Grand Coulee dam. Water was stored in Arrow reservoir instead of by Grand Coulee dam until the middle of May at which time storing in Arrow was discontinued in order to fill Grand Coulee reservoir at a maximum rate. After the end of May operation was about normal.

The Entities have agreed that if possible, operation in March 1970 will be carried out so as to facilitate completion of work in the Arrow reservoir.

MICA PROJECT

Five culverts pass combined flow of Wood and Canoe Rivers under right-bank haul road. April 1969.

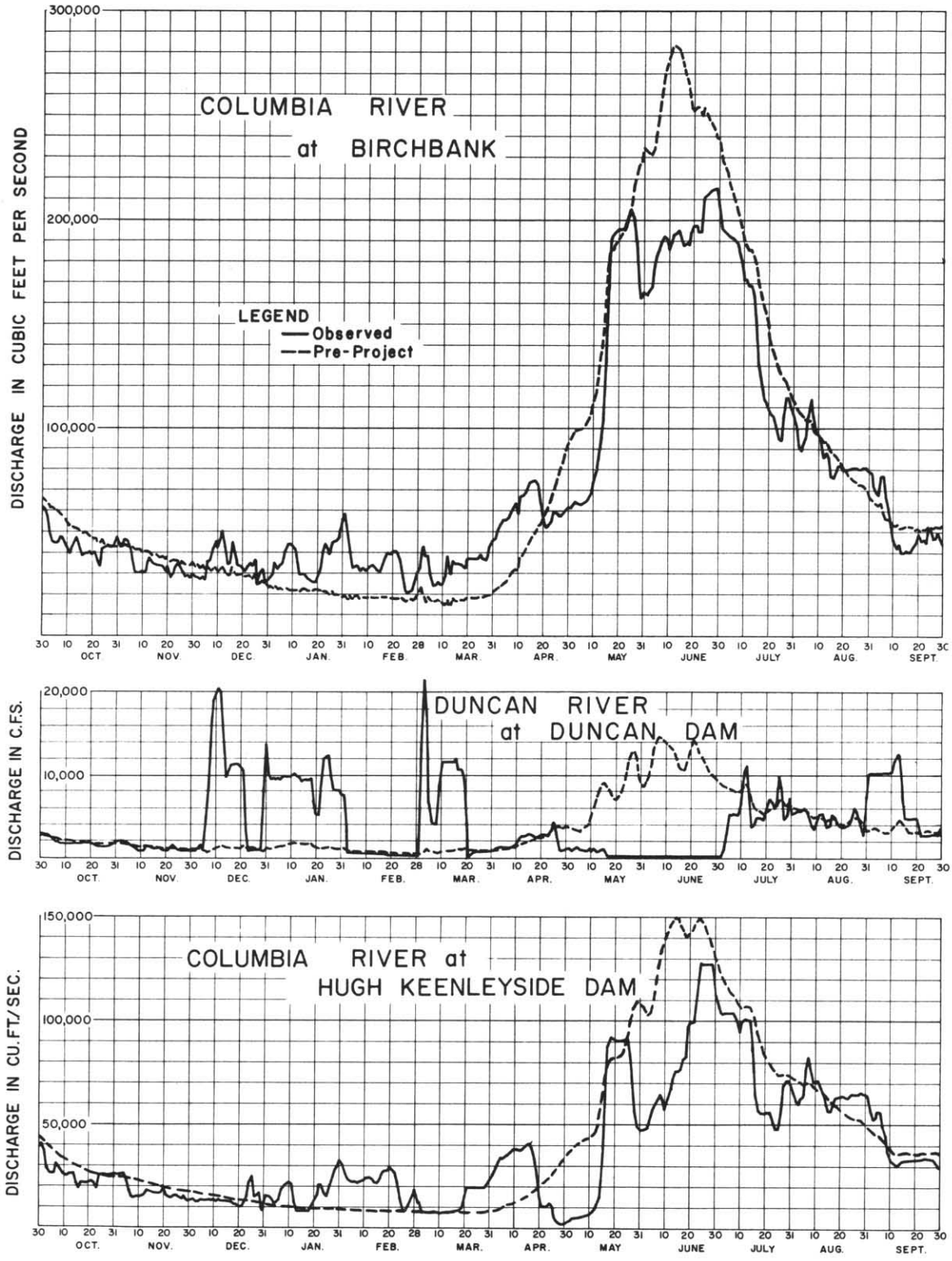


BENEFITS

Flood Control Payment

Article VI(1)(b) of the Treaty provides that the United States shall pay Canada $52,100,000 in United States funds upon commencement of operation of the storage at Arrow Dam. The Arrow project was declared operational on 10 October 1968 and the flood control payment amounting to $55,909,812.50 in Canadian funds was received by Canada on the same day.

Article IV(6) of the Treaty requires that the Duncan and Arrow storages shall commence full operation by September 1969. As the Duncan and Arrow storages were placed in operation on 31 July 1967 and on 10 October 1968 respectively, both reservoirs have been effective in providing flood control for longer periods than were used in determining the amounts to be paid Canada under Article VI of the Treaty. The United States has agreed to pay $278,000 in United States funds for the additional flood control and is seeking Congressional Approval.



HYDROGRAPHS - Observed and Pre-Project flows for the year ending 30 September 1969.

Flood Control Provided

The effect of storage in the Duncan and Arrow reservoirs on flows at the sites and on flows of the Columbia River at Birchbank is illustrated on page 33 by hydrographs which show actual discharges and pre-project flows that would have occurred if the dams had not been built. It is noted that the pre-project hydrograph for Birchbank has been computed on the assumption that the effect of Duncan and Arrow regulation and of the regulation provided by storage on Kootenay Lake have been removed.

It is estimated that the Duncan project reduced the peak stage by about 1.4 feet on Kootenay Lake and that the Arrow and Duncan projects reduced the peak stage of the Columbia River at Trail, British Columbia by about six feet.

The operation of Columbia Basin reservoirs for the system as a whole reduced the peak discharge of the Columbia River near The Dalles, Oregon by approximately 180,000 cfs to 435,000 cfs. The corresponding reduction in peak stage at Vancouver, Washington amounted to about six feet. The Arrow project contributed about 23 percent of the total effective storage in the Columbia reservoir system during the period of control of the lower Columbia River and the Duncan project about four percent.

Power Benefits

In recognition of the advanced partial operation of the Arrow project the special operating program for Canadian storage during the period 1 April 1968 through 30 June 1969 made provision for Canada to receive from the United States 158 megawatts of firm capacity and 86 average megawatts of energy during the period 1 April 1968 to 31 March 1969. During the previous report year a total of 445,321,000 kilowatt hours of electrical energy was received under this program by the Canadian Entity. In this report year 390,215,000 kilowatt hours of energy were received at rates up to a maximum of 200,000 kilowatts. The total additional energy benefits received by the Canadian Entity under this program therefore amounted to 835,536,000 kilowatt hours.

LIBBY PROJECT

Placing concrete with 4 cubic yard bucket upstream from trestle. July 1969.

CONCLUSIONS

1. Duncan Dam is complete. The Arrow project was declared operational on 10 October 1968 and the Mica and Libby projects are proceeding on schedule.

2. Entity studies pertaining to development of the hydrometeorological network, power and flood control operating plans, and the annual calculation of downstream power benefits are proceeding satisfactorily.

3. The Duncan and Arrow projects have been operated in conformity with the provisions of the Treaty, the special operating program approved by the two governments, the interim flood control operating plan for Duncan and Arrow reservoirs, and the hydroelectric operating plans for Canadian storage which have been submitted to governments for approval by an exchange of notes.

4. Finally, the Board concludes that the objectives of the Treaty are being met.

APPENDIX A

COLUMBIA RIVER TREATY PERMANENT ENGINEERING BOARD

Members

United States	Canada
Mr. Wendell E. Johnson, Chairman Chief, Engineering Division, Civil Works Directorate, Office, Chief of Engineers, U.S. Army, Washington, D.C.	Mr. G.M. MacNabb, Chairman Assistant Deputy Minister, Energy Development, Department of Energy, Mines and Resources, Ottawa, Ontario
Mr. Morgan D. Dubrow Assistant and Chief Engineering Research Advisor, Office of the Assistant Secretary for Water and Power Development, Department of the Interior, Washington, D.C.	Mr. A.F. Paget Consultant, Water Resources Service, Department of Lands, Forests, and Water Resources, Victoria, B.C.

Alternates

Mr. Fred L. Thrall Chief, Water Conservation Branch, Civil Works Directorate, Office, Chief of Engineers, U.S. Army, Washington, D.C.	Mr. E.M. Clark Regional Engineer, Engineering Division, Department of Energy, Mines and Resources, Vancouver, B.C.
Mr. J. Emerson Harper Assistant and Power Advisor, Office of the Assistant Secretary for Water and Power Development, Department of the Interior, Washington, D.C.	Mr. H.M. Hunt Chief, Power and Major Licences Division, Water Resources Service, Department of Lands, Forests, and Water Resources, Victoria, B.C.

Secretaries

Mr. Verle Farrow (1) Assistant Chief, Hydrology and Hydraulics Branch, Civil Works Directorate, Office, Chief of Engineers, U.S. Army, Washington, D.C.	Mr. E.M. Clark Regional Engineer, Engineering Division, Department of Energy, Mines and Resources, Vancouver, B.C.

(1) Vice Mr. John W. Roche as of 15 April 1969.

APPENDIX B

COLUMBIA RIVER TREATY ENTITIES

United States

Mr. H.R. Richmond, Chairman

Administrator, Bonneville Power Administration,
Department of the Interior,
Portland, Oregon

Brigadier General Roy S. Kelley(2)

Division Engineer, North Pacific Division,
Corps of Engineers,
U.S. Army,
Portland, Oregon

Canada

The Honourable R.G. Williston, Chairman(1)

Minister of Lands, Forests and Water Resources,
Victoria, B.C.

(1) Vice Dr. H.L. Keenleyside as of 1 July 1969.

(2) Vice Brigadier General Elmer P. Yates as of 10 February 1969.

APPENDIX C

RECORD OF FLOWS

AT THE

INTERNATIONAL BOUNDARY

	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	60,600	43,900	28,000	28,500	58,700	32,200	46,900	61,600	165,000	197,000	101,000	78,600
2	57,400	43,700	28,000	29,600	48,400	42,400	50,700	62,900	166,000	195,000	92,000	72,600
3	48,900	46,200	26,900	34,800	40,200	38,800	53,200	64,100	168,000	194,000	89,100	69,700
4	45,400	45,300	28,300	32,800	32,500	38,800	55,900	64,100	176,000	193,000	92,300	68,400
5	44,800	41,800	26,800	33,500	33,400	28,800	55,900	63,400	183,000	192,000	96,000	77,800
6	44,900	36,700	35,400	34,700	33,800	23,700	56,500	63,500	186,000	191,000	106,000	77,000
7	47,800	31,000	36,500	41,000	30,700	24,000	58,600	64,300	190,000	189,000	114,000	67,400
8	47,200	30,200	41,800	43,500	31,700	25,100	60,900	66,000	192,000	185,000	106,000	61,600
9	44,700	31,000	45,200	43,700	30,800	24,800	63,200	68,600	191,000	179,000	99,300	53,700
10	42,700	30,600	42,300	43,200	32,000	25,000	58,200	73,200	186,000	172,000	97,700	47,400
11	39,900	30,900	45,700	41,300	33,600	28,200	66,600	78,400	190,000	172,000	94,500	42,700
12	43,000	35,800	50,100	35,400	33,900	38,200	66,800	85,400	193,000	169,000	86,500	44,300
13	45,800	37,700	42,500	29,300	32,800	29,700	68,700	94,800	194,000	169,000	87,800	40,900
14	47,100	34,600	33,700	29,900	31,900	35,900	71,700	104,000	195,000	166,000	86,000	40,000
15	42,200	34,100	34,400	29,300	31,300	34,800	73,400	133,000	191,000	154,000	77,900	41,400
16	38,400	33,700	44,700	27,200	33,200	34,400	74,400	169,000	188,000	131,000	76,700	40,900
17	39,900	33,400	39,800	26,300	37,700	34,200	74,600	189,000	189,000	119,000	79,800	41,300
18	39,900	33,000	34,600	25,900	39,800	33,800	72,700	193,000	188,000	114,000	82,500	43,600
19	40,100	30,900	33,700	26,000	39,100	32,500	64,600	194,000	194,000	112,000	82,100	45,900
20	39,400	33,000	33,600	28,500	40,800	37,400	55,500	195,000	197,000	109,000	79,500	49,800
21	40,100	27,300	31,000	32,600	40,900	37,400	51,800	195,000	197,000	107,000	80,200	46,400
22	36,400	29,900	33,000	39,300	39,600	37,200	52,500	196,000	194,000	106,000	80,200	47,700
23	33,600	32,500	34,400	43,100	36,600	37,000	54,400	198,000	194,000	101,000	80,500	45,800
24	41,500	34,900	33,600	42,200	28,800	37,200	59,200	201,000	211,000	95,800	81,300	52,100
25	42,700	32,200	35,700	39,300	21,400	38,800	59,000	204,000	212,000	94,400	81,600	51,800
26	42,900	30,600	25,000	44,900	20,300	37,100	58,000	201,000	213,000	105,000	80,200	47,800
27	42,500	28,300	30,400	45,100	21,700	36,900	57,900	190,000	214,000	114,000	80,000	47,900
28	42,400	29,100	31,900	46,400	30,400	38,400	58,800	175,000	215,000	114,000	81,100	50,700
29	42,100	27,500	30,000	47,700		40,000	60,300	163,000	215,000	110,000	81,400	47,000
30	44,600	29,500	25,400	50,500		42,600	61,000	164,000	208,000	109,000	79,700	45,200
31	47,400		26,400	55,100		45,200		165,000		107,000	79,200	
Mean	43,800	34,000	34,500	37,100	34,500	34,500	60,700	134,000	193,000	144,000	87,500	52,900

COLUMBIA RIVER AT BIRCHBANK, B.C. - Daily discharges for the year ending 30 September 1969 in cubic feet per second.

	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	10,200	9,940	7,820	2,800	4,330	4,750	16,000	41,200	77,600	59,800	16,800	7,990
2	10,100	10,100	7,600	3,240	4,540	4,870	17,600	39,100	71,500	55,000	15,700	7,680
3	9,780	9,990	7,180	3,790	4,720	4,960	18,300	36,500	68,400	52,700	15,000	7,160
4	9,270	9,880	8,000	4,230	4,860	5,040	18,600	34,800	71,900	51,000	14,600	7,120
5	9,110	9,700	8,400	4,910	4,920	5,170	18,500	33,900	77,100	50,700	14,000	6,990
6	8,960	9,360	8,120	5,520	5,020	5,140	19,900	35,000	82,400	49,500	13,600	7,080
7	8,860	8,980	7,410	6,130	5,160	5,140	22,400	38,800	87,500	47,000	13,200	7,060
8	8,860	8,690	6,880	6,490	5,160	5,150	24,600	43,600	88,500	44,300	12,800	7,060
9	8,730	8,380	6,970	6,680	5,120	5,170	24,800	48,700	83,500	41,400	12,800	6,670
10	8,450	8,390	7,190	6,870	5,100	5,000	25,400	55,700	74,900	38,700	12,100	6,560
11	8,130	8,050	8,160	6,840	5,020	5,000	26,300	64,800	67,700	37,000	11,700	6,210
12	8,650	9,030	8,880	6,850	5,020	5,050	27,200	73,800	65,300	35,800	11,000	6,190
13	9,490	10,100	8,830	6,770	4,920	5,040	27,700	82,500	63,200	35,000	10,900	5,880
14	9,720	10,200	8,320	6,770	4,930	5,090	28,200	88,500	59,200	33,900	11,000	6,090
15	9,830	9,490	7,410	6,570	4,940	5,070	29,000	91,400	52,400	31,300	10,900	6,330
16	9,630	9,120	7,520	6,440	4,940	5,160	28,900	91,000	46,700	29,100	10,100	6,390
17	9,600	8,790	7,660	6,220	5,040	5,290	29,200	84,500	43,000	27,100	10,100	6,760
18	9,130	8,480	7,270	6,140	5,070	5,340	30,600	69,100	41,200	25,400	9,940	6,810
19	8,980	8,130	7,180	5,820	5,070	6,140	33,000	76,500	40,700	24,100	10,100	6,820
20	8,630	8,040	7,240	5,430	5,080	7,170	33,700	65,300	41,900	23,000	9,640	6,780
21	8,800	7,550	6,700	5,080	4,980	7,510	33,200	61,700	45,200	22,200	9,150	6,980
22	8,580	7,980	6,520	4,810	4,970	7,530	33,500	59,800	51,300	21,700	9,100	7,330
23	8,450	9,360	6,510	4,470	4,860	7,410	34,000	60,000	54,800	21,500	8,930	7,580
24	8,300	10,000	6,140	4,370	4,870	7,450	40,800	64,000	53,500	21,000	8,870	7,950
25	8,290	9,730	6,290	4,280	4,860	7,440	52,600	69,600	53,200	20,100	8,870	8,230
26	8,640	9,220	6,380	4,180	4,770	7,540	53,400	77,000	55,000	20,500	8,600	8,120
27	9,140	8,670	5,990	4,190	4,760	7,610	48,700	83,800	60,900	19,900	8,840	8,370
28	9,210	8,340	6,180	4,180	4,750	8,590	43,600	85,700	63,800	19,900	8,790	8,270
29	9,400	8,080	5,120	4,160		9,910	42,800	81,300	64,100	18,800	9,000	8,070
30	9,580	7,720	4,300	4,150		11,100	42,600	82,300	63,100	17,700	8,630	8,150
31	9,970		3,220	4,200		12,700		82,300		17,300	8,440	
Mean	9,110	8,980	7,010	5,250	4,920	6,440	30,800	64,600	62,300	32,700	11,100	7,160

KOOTENAI RIVER AT PORTHILL, IDAHO - Daily discharges for the year ending 30 September 1969 in cubic feet per second.

APPENDIX D

EXCHANGE OF NOTES

RELATING TO

SPECIAL OPERATING PROGRAM FOR CANADIAN STORAGE

Ottawa, December 30, 1968

No. X-697

Excellency,

I have the honour to refer to the Treaty between Canada and the United States of America relating to the co-operative development of water resources of the Columbia River Basin signed at Washington on January 17, 1961 which entered into force on September 16, 1964 and in particular to Article XIV.4.

The construction of the dam near the outlet of Arrow Lakes, British Columbia, under the terms of Article II.2(b) of the Treaty, has been completed to a stage where storage to elevation 1404 feet in the Lower Arrow Lake can be operated for power purposes during the period April 1, 1968 to March 31, 1969 in conjunction with the fully operative storage near Duncan Lake, British Columbia, specified in Article II.2(c) of the Treaty, and in accordance with the special arrangements agreed to between the United States and Canadian entities as described in the attached document entitled "Columbia River Treaty Special Operating Programme for the Canadian Storage during period April 1, 1968 through June 30, 1969". Coverage of the April 1, 1969 to June 30, 1969 period for both the Duncan and Arrow Storages is included in the Special Operating Programme to bring the operation to the start of a July 1 to June 30 operating year, a period which normally includes a complete cycle of high and low river flows.

The entities have agreed that they will be free to make changes from time to time to the documents referred to in sub-paragraphs (a) to (d) inclusive of paragraph 2 of the Special Operating Programme within the framework of Article XIV of the Treaty and, similarly, to develop within this framework the Flood Control Operating Plan referred to in the final sub-paragraph of paragraph 2 of the Special Operating Programme. It is expected that the entities will have agreed to this plan by December 31, 1968.

I have the honour to propose that this Special Operating Programme, as set out in this Note and in the Annex to this Note, and the agreement of the entities in regard to the manner in which paragraph 2 of the Special Operating Programme should be interpreted as set out in this Note, be hereby made effective and be hereby confirmed by our two Governments and that the two entities be hereby empowered and charged, pursuant to Article XIV.4 of the Treaty to proceed on the basis hereinbefore stated.

I have the honour further to propose that if this proposal meets with the approval of the Government of the United States of America, this Note which, together with its attachment, is authentic in English and French, and your reply shall constitute an agreement between our two Governments relating to the Treaty, with effect from April 1, 1968.

Accept, Excellency, the renewed assurances of my highest consideration.

"Mitchell Sharp"
Secretary of State for
External Affairs

His Excellency the Honourable Harold Francis Linder
Ambassador of the United States of America
Ottawa, Ontario

26 February 1968

COLUMBIA RIVER TREATY

SPECIAL OPERATING PROGRAM FOR CANADIAN STORAGE DURING THE PERIOD 1 APRIL 1968 THROUGH 30 JUNE 1969

1. INTRODUCTION

Prior to 1 April 1968, the Canadian Storage is to be operated in accordance with the "Special Operating Program for the Duncan Reservoir for the Period April 30, 1967 through March 31, 1968," agreed by the Governments of Canada and the United States through an Exchange of Notes dated 8 and 18 May 1967.

The Arrow project will be completed sufficiently to permit closure and operation of partial storage for power purposes in the operating year 1968-69. It is scheduled to become fully operative for flood control by about 15 December 1968. The Canadian and United States Entities agree that, during the period 1 April 1968 through 30 June 1969, the Canadian Storage will be operated in accordance with this Special Operating Program; and agree that a predetermined share of downstream power benefits will be delivered to the Canadian Entity as described herein.

2. REFERENCES

The Canadian and United States Entities have agreed on the following related documents:

(a) "Principles and Procedures for the Preparation and Use of Hydroelectric Operating Plans for Canadian Treaty Storage," dated July 25, 1967, hereinafter referred to as the "Principles and Procedures;"

(b) "Special Operating Plan for Duncan Reservoir during the Period 1 August 1967 through 31 July 1968," dated 5 December 1967, hereinafter referred to as the "Special Operating Plan for Duncan;"

(c) "Interim Flood Control Operating Plan for Duncan Reservoir 1967-68," dated 8 December 1967, hereinafter referred to as the "Flood Control Plan for Duncan;"

(d) "Program for Initial Filling of Arrow Reservoir Fully Operative April 1, 1969," dated July 26, 1967, hereinafter referred to as the "Program for Initial Filling of Arrow."

In addition, it is expected the Entities will have agreed to the Flood Control Operating Plan for Columbia River Treaty Storage by 1 September 1968, hereinafter referred to as the "Flood Control Operating Plan."

3. DUNCAN RESERVOIR

(a) Operating Rule Curve

For the period 1 April 1968 through 31 July 1968, the Operating Rule Curve for Duncan storage will be that developed for the Special Operating Plan for Duncan.

For the period 1 August 1968 through 30 June 1969, an Operating Rule Curve will be developed for Duncan storage in accordance with the Principles and Procedures. The Entities will agree on the Critical Rule Curve for this operating year by 1 July 1968, and on the Assured Refill Curve and the procedures to develop Variable Refill Curves by 1 September 1968.

(b) Flood Control Operating Rules

Flood control operating rules for the Duncan Reservoir for 1967-68 will be established in accordance with the Flood Control Plan for Duncan. The operating rules for 1968-69 will be established in accordance with the Flood Control Operating Plan.

4. ARROW RESERVOIR

On or about 1 February 1968, closure will be made of the earthfill portion of the Arrow dam and water will be diverted through the discharge works of the dam. The top elevation of the earth dam at that time will be about 1380 feet, and it is scheduled to be constructed to 1410 feet by 1 April 1968. Construction to the full crest elevation of 1459 feet is scheduled to be completed by 1 July 1968. Until the flood hazard of the 1968 flood is passed, the natural flows less any involuntary storage will be passed through the 8 low-level ports and over uncompleted rollways of the 3 sluiceways and the completed rollway of the fourth. Construction of the remaining uncompleted rollways and the control works is scheduled for completion by 15 December 1968.

When the flood hazard has passed and after consultation with the U.S. Entity, the Canadian Entity at its discretion will install stoplogs in the uncompleted sluiceways and will operate the reservoir by controlling flows through the 8 low-level ports with the objective of attaining a water surface elevation of 1404 feet in Lower Arrow Lake by 31 July 1968. If storage content to this elevation has not been attained by 31 July 1968, any filling during August will be as agreed by the Entities.

During the 1968 flood the Canadian Entity will use its best effort to preclude adding to the flood hazard downstream from Arrow reservoir.

Arrow will become partially operative for power purposes under this Special Operating Program commencing 1 August 1968, and until 1 April 1969 will be operated for power with a storage content not to exceed that of elevation 1404 feet except as provided under subsection (e) below.

Under present scheduling, Arrow will be made fully operative for flood control in accordance with the Treaty as soon as possible and presently expected to be about 15 December 1968.

(a) Operating Rule Curve

For the period 1 August 1968 through 31 March 1969, an Operating Rule Curve will be developed in accordance with the Principles and Procedures. The Entities will agree on the Critical Rule Curve for this period by 1 July 1968, and on the Assured Refill Curve by 1 September 1968.

For the period 1 April 1969 through 30 June 1969, the Operating Rule Curve for Arrow storage will be the same as that developed in accordance with the Program for Initial Filling of Arrow. The Entities will agree on the requirements for this Operating Rule Curve by 1 September 1968.

(b) Flood Control Operating Rules

Flood control operating rules for the Arrow Reservoir for 1968-69 will be established in accordance with the Flood Control Operating Plan.

(c) Canadian Share of Downstream Power Benefits

As a result of the operation of Arrow Reservoir under this Special Operating Program, power benefits will result at hydroelectric plants downstream in the United States. The Entities are agreed, subject to the Arrow Reservoir being filled to elevation 1404 feet prior to 1 September 1968, that the Canadian Share of these power benefits after allowing 5% transmission losses on capacity and energy to the United States - Canadian border is 158 mw of firm capacity and 86 average mw of energy during the period 1 April 1968 through 31 March 1969.

(d) Adjustment of Canadian Share for Storage Content below elevation 1404 feet

If the storage content of Arrow Reservoir has not reached a controlled elevation of 1404 feet in Lower Arrow Lake prior to 1 September 1968, the Canadian Share of the downstream capacity and energy

benefit will, if desired by either party, be redetermined for the maximum controlled storage content attained in a manner consistent with the original determination and adjusted at 1 September 1968 to the redetermined amounts. The redetermined energy share during the period 1 September 1968 through 31 March 1969 will be further adjusted to reflect any over-delivery made in the period 1 April through 31 August 1968; provided however, if any over-delivery in the period 1 April 1968 through 31 August 1968 was made from surplus United States energy, such over-delivery will, at the request of the Canadian Entity, be transferred at the appropriate rate to the credit of the Bonneville Power Administrator in the exchange energy account between British Columbia Hydro and Power Authority and the Bonneville Power Administrator, and will be excluded from the further adjustment described above.

(e) Additional Energy Benefit from Storage Content above elevation 1404 feet.

If, by agreement of the Entities, controlled storage content above elevation 1404 feet has been achieved by 1 September 1968, energy in addition to the Canadian Share in amounts agreed by the Entities will be delivered to Canada.

(f) Delivery of Canadian Share

Commencing 1 April 1968, and continuing until 31 March 1969, the Bonneville Power Administrator shall deliver at Blaine, Washington, to the B.C. Hydro and Power Authority the Canadian Share.

The Canadian Share of energy shall be delivered in weekly amounts as scheduled by the B.C. Hydro and Power Authority in the amounts of 102 average mw during the period 1 April 1968 through 31 October 1968 and 86 average mw during the period 1 November 1968 through 31 March 1969. The capacity benefits will be 158 mw during the period 1 April 1968 through 31 October 1968 and 110 mw during the period 1 November 1968 through 31 March 1969. If the Canadian Share is reduced in accordance with subsection 4(d), the delivery of the Canadian Share will be adjusted to reflect such reduction. Further exchange of the Canadian Share of energy and capacity benefits may be made as agreed by the Entities.

The wheeling charge to be paid by the B.C. Hydro and Power Authority to the Bonneville Power Administrator for delivery of the Canadian Share in each month will be 0.237 dollars (U.S.) per kilowatt multiplied by the maximum hourly rate in kilowatts at which delivery at Blaine of the Canadian Share is scheduled in that month.

(g) Delayed Deliveries

If deliveries of energy are delayed due to uncontrollable forces or scheduled facility outage, such deliveries shall be made at a time and at a rate agreed by the Entities.

5. OPERATIONS

During the period 1 April 1968 through 31 July 1968, the Duncan Reservoir will be operated for power purposes in accordance with the Special Operating Plan for Duncan and for flood control purposes in accordance with the Flood Control Plan for Duncan.

For the period 1 August 1968 through 30 June 1969, an Operating Rule Curve for the whole of the Canadian Treaty Storage will be prepared by combining the Operating Rule Curves for Duncan and Arrow Reservoirs and the actual operation of the whole of the Canadian Treaty Storage for power purposes will be guided by this Operating Rule Curve in accordance with Section 22 of the Principles and Procedures.

Flood control operation of the Duncan Reservoir during 1968-69 and of the Arrow Reservoir following Arrow becoming fully operative will be in accordance with the Flood Control Operating Plan.

6. APPLICABILITY OF TREATY

This document is subject to the provisions of the Treaty.

Ottawa, February 26, 1969

No. 39

Sir:

I have the honor to refer to your Note No. X-697 of December 30, 1968, and the document attached thereto, concerning the Special Operating Programme for the Canadian storage at the projects specified in Article II(2)(c) and II(2)(b) of the 1961 Columbia River Treaty.

I wish to advise that the Government of the United States accepts the proposals set forth in your Note and agrees that your Note and attachment, together with this reply, shall constitute an agreement between our two Governments relating to the Treaty with effect from April 1, 1968.

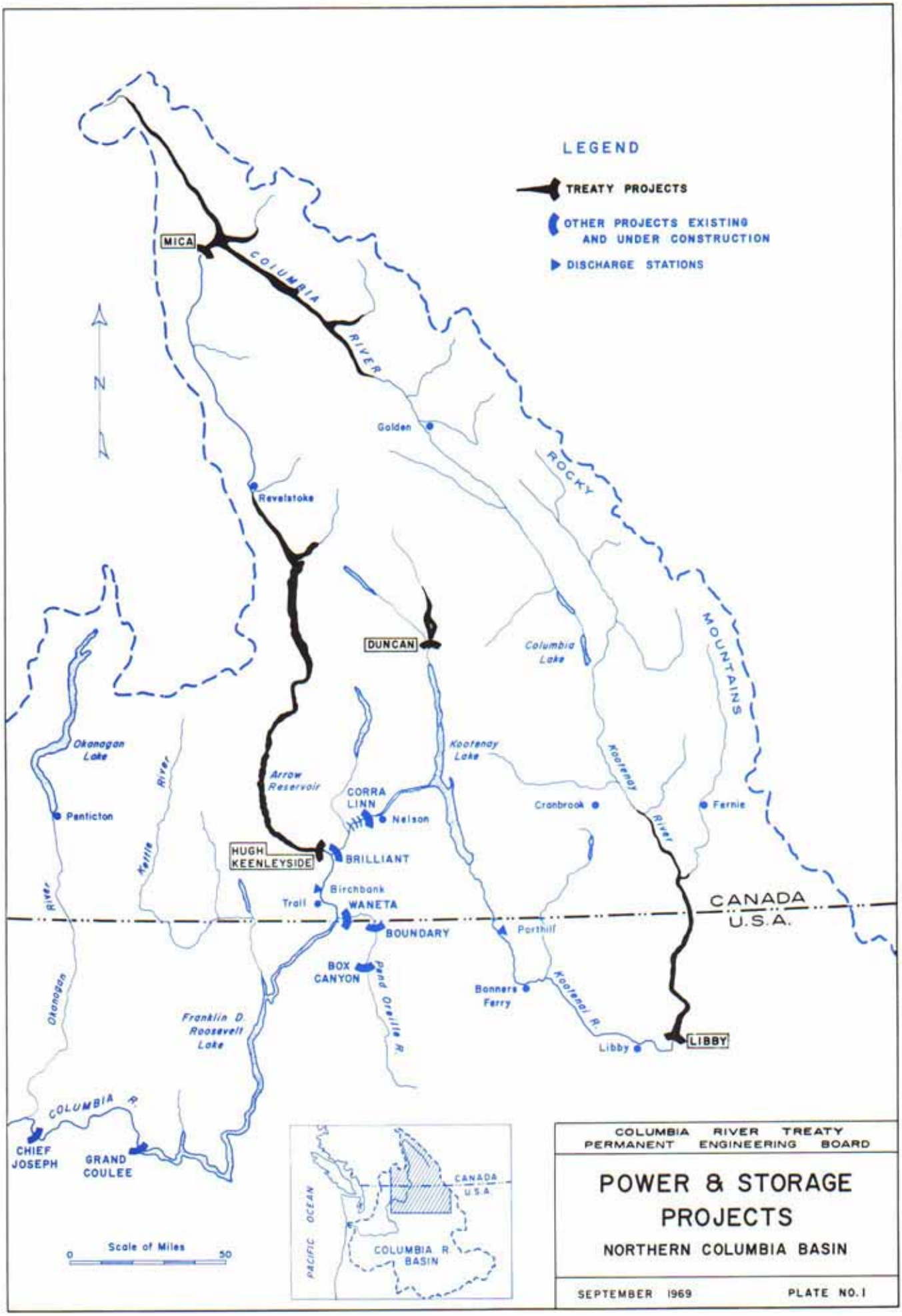
Accept, Sir, the renewed assurances of my highest consideration.

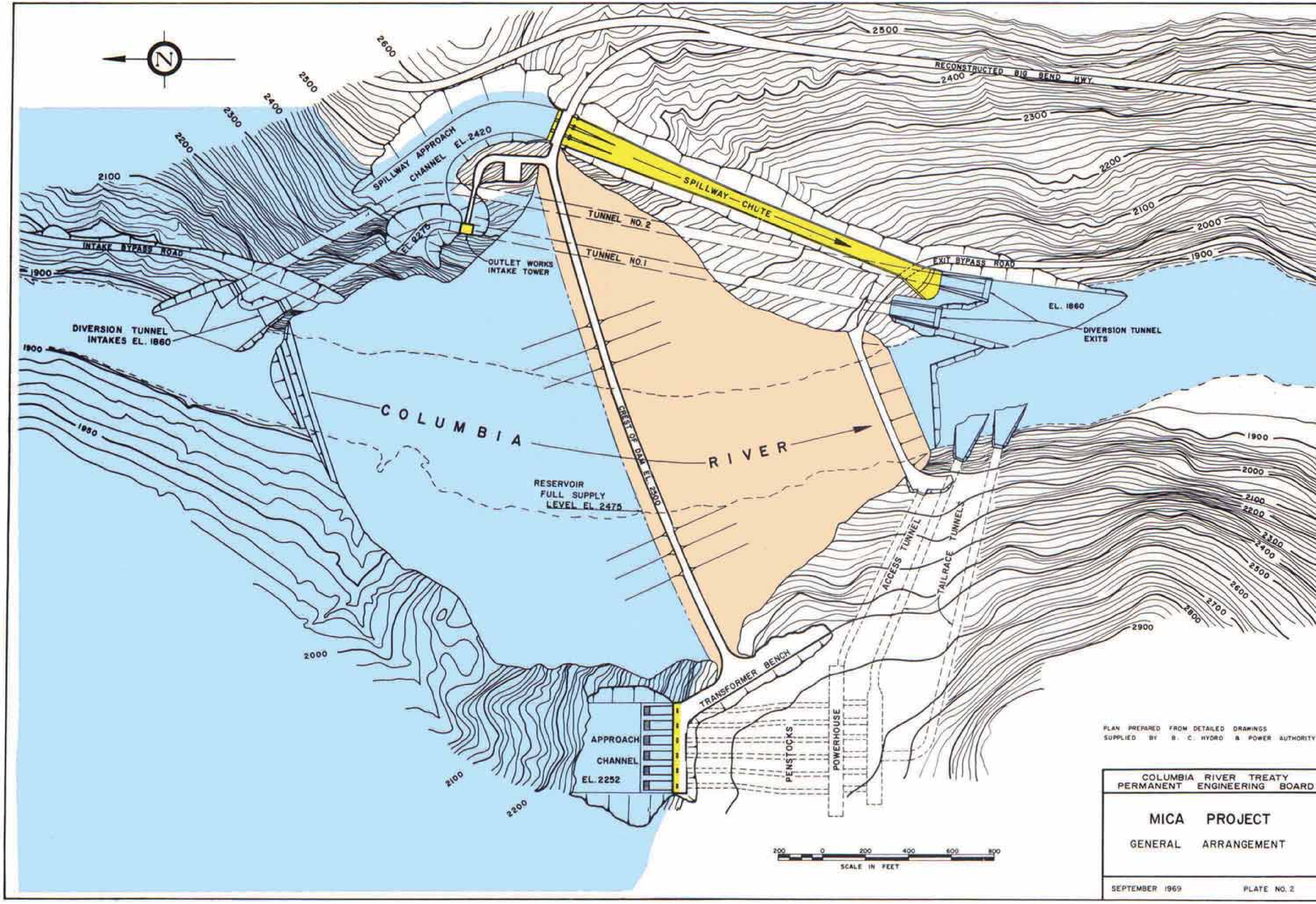
"Harold F. Linder"

The Honorable
Mitchell Sharp,
Secretary of State
for External Affairs,
Ottawa.

APPENDIX E

LIST OF PLATES


LEGEND
TREATY PROJECTS
OTHER PROJECTS EXISTING AND UNDER CONSTRUCTION
DISCHARGE STATIONS
MICA
COLUMBIA RIVER
N
Golden
ROCKY MOUNTAINS
Revelstoke
DUNCAN
Columbia Lake
Okanagan Lake
Kootenay Lake
Kootenay River
Arrow Reservoir
CORRA LINN
Nelson
Cranbrook
Fernie
Penticton
Kettle River
HUGH KEENLEYSIDE
BRILLIANT
Birchbank
Trail
WANETA
CANADA
U.S.A.
BOUNDARY
Porthill
BOX CANYON
Pend Oreille R.
Bonners Ferry
Kootenai R.
Okanogan River
Franklin D. Roosevelt Lake
Libby
LIBBY
COLUMBIA R.
CHIEF JOSEPH
GRAND COULEE
Scale of Miles
0
50
PACIFIC OCEAN
CANADA
U.S.A.
COLUMBIA R. BASIN
COLUMBIA RIVER TREATY
PERMANENT ENGINEERING BOARD
POWER & STORAGE PROJECTS
NORTHERN COLUMBIA BASIN
SEPTEMBER 1969
PLATE NO. 1


N
2500
RECONSTRUCTED BIG BEND HWY.
2400
2300
2200
2100
2000
1900
2600
2500
2400
2300
2200
2100
SPILLWAY APPROACH CHANNEL EL. 2420
SPILLWAY CHUTE
EL. 2275
TUNNEL NO. 2
TUNNEL NO. 1
OUTLET WORKS INTAKE TOWER
INTAKE BYPASS ROAD
1900
EXIT BYPASS ROAD
EL. 1860
DIVERSION TUNNEL EXITS
DIVERSION TUNNEL INTAKES EL. 1860
1900
1950
COLUMBIA RIVER
CREST OF DAM EL. 2500
RESERVOIR FULL SUPPLY LEVEL EL. 2475
1900
2000
2100
2200
2300
2400
2500
2600
2700
2800
2900
ACCESS TUNNEL
TAILRACE TUNNELS
2000
TRANSFORMER BENCH
APPROACH CHANNEL EL. 2252
PENSTOCKS
POWERHOUSE
2100
2200
200 0 200 400 600 800
SCALE IN FEET

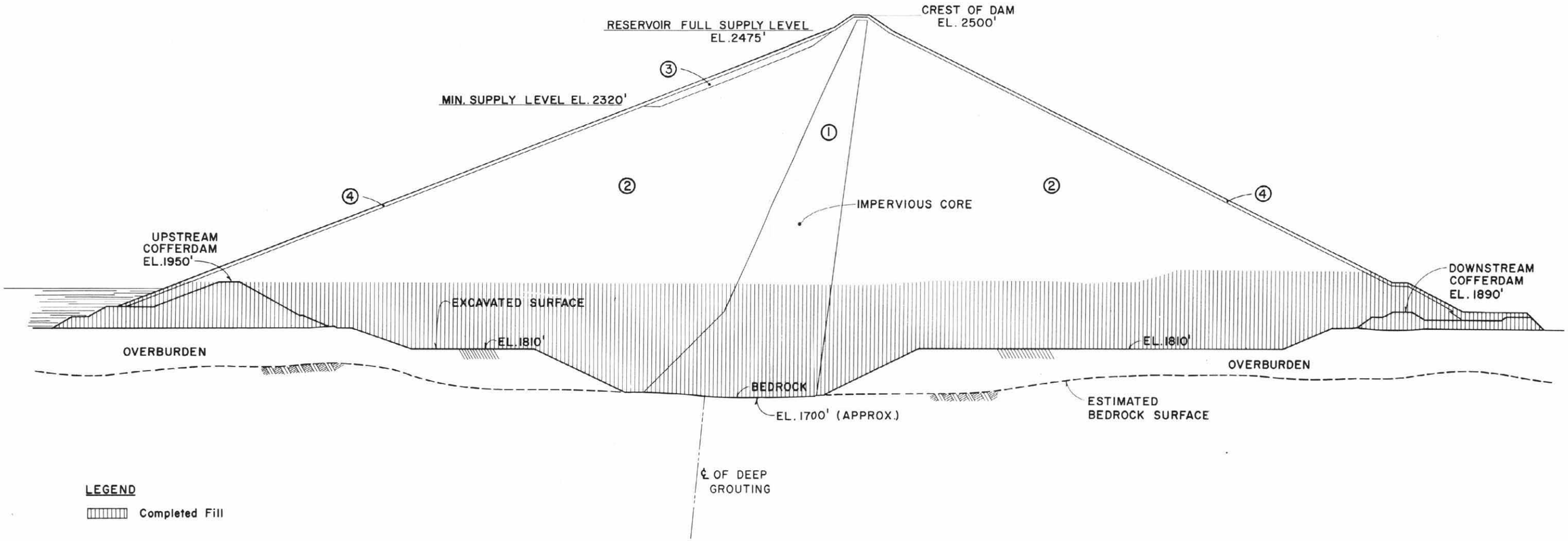
PLAN PREPARED FROM DETAILED DRAWINGS SUPPLIED BY B. C. HYDRO & POWER AUTHORITY

COLUMBIA RIVER TREATY
PERMANENT ENGINEERING BOARD

MICA PROJECT

GENERAL ARRANGEMENT

SEPTEMBER 1969 PLATE NO. 2



LEGEND

Completed Fill

ZONE	MATERIAL
①	IMPERVIOUS FILL
②	PERVIOUS FILL
③	FILTER
④	RIP RAP

EMBANKMENT SECTION

100 0 100 200 300

SCALE IN FEET

PLAN PREPARED FROM DETAILED DRAWINGS SUPPLIED BY B.C. HYDRO & POWER AUTHORITY.

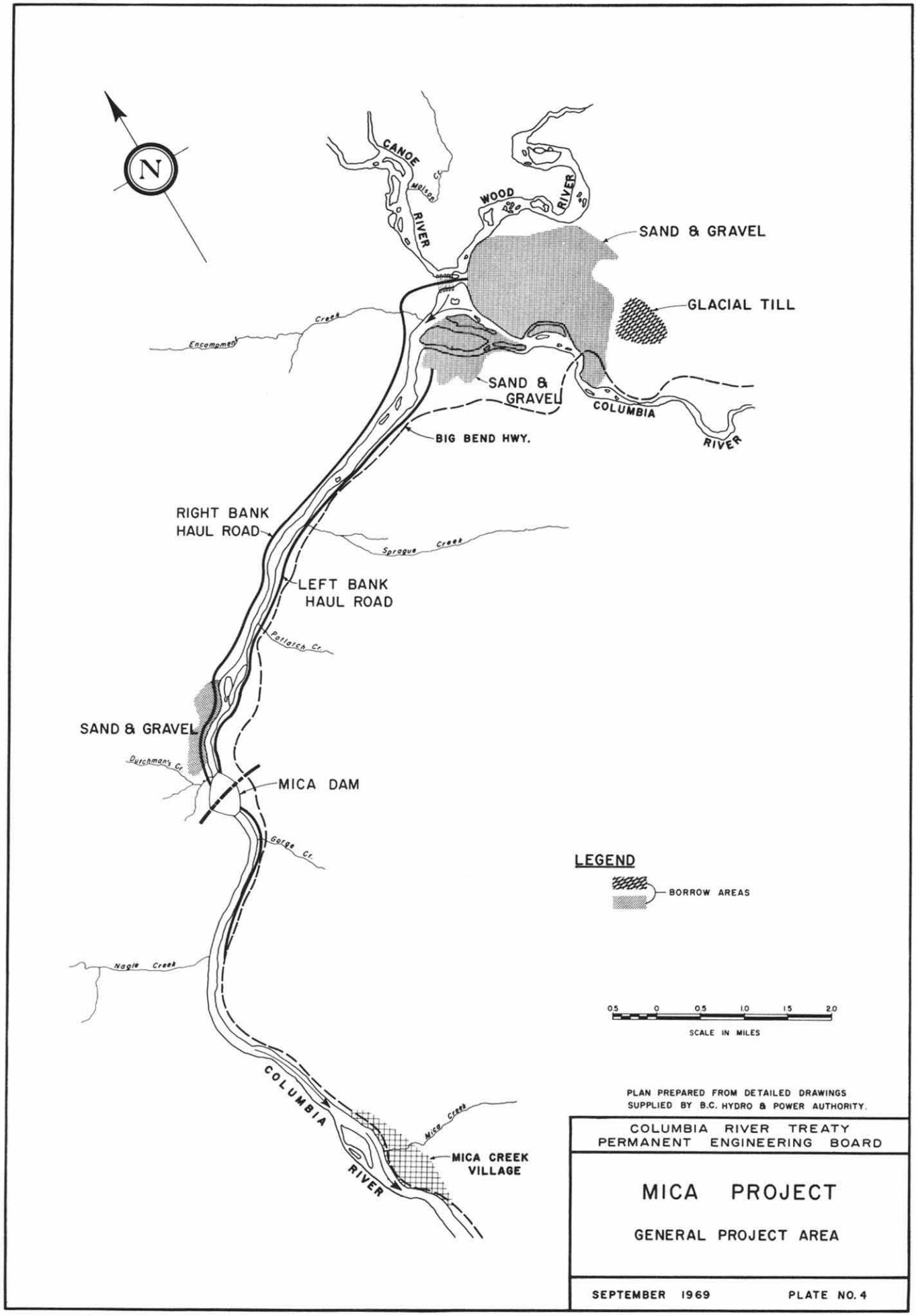
COLUMBIA RIVER TREATY
PERMANENT ENGINEERING BOARD

MICA PROJECT

PROGRESS CHART

OF DAM

SEPTEMBER 1969 PLATE NO. 3



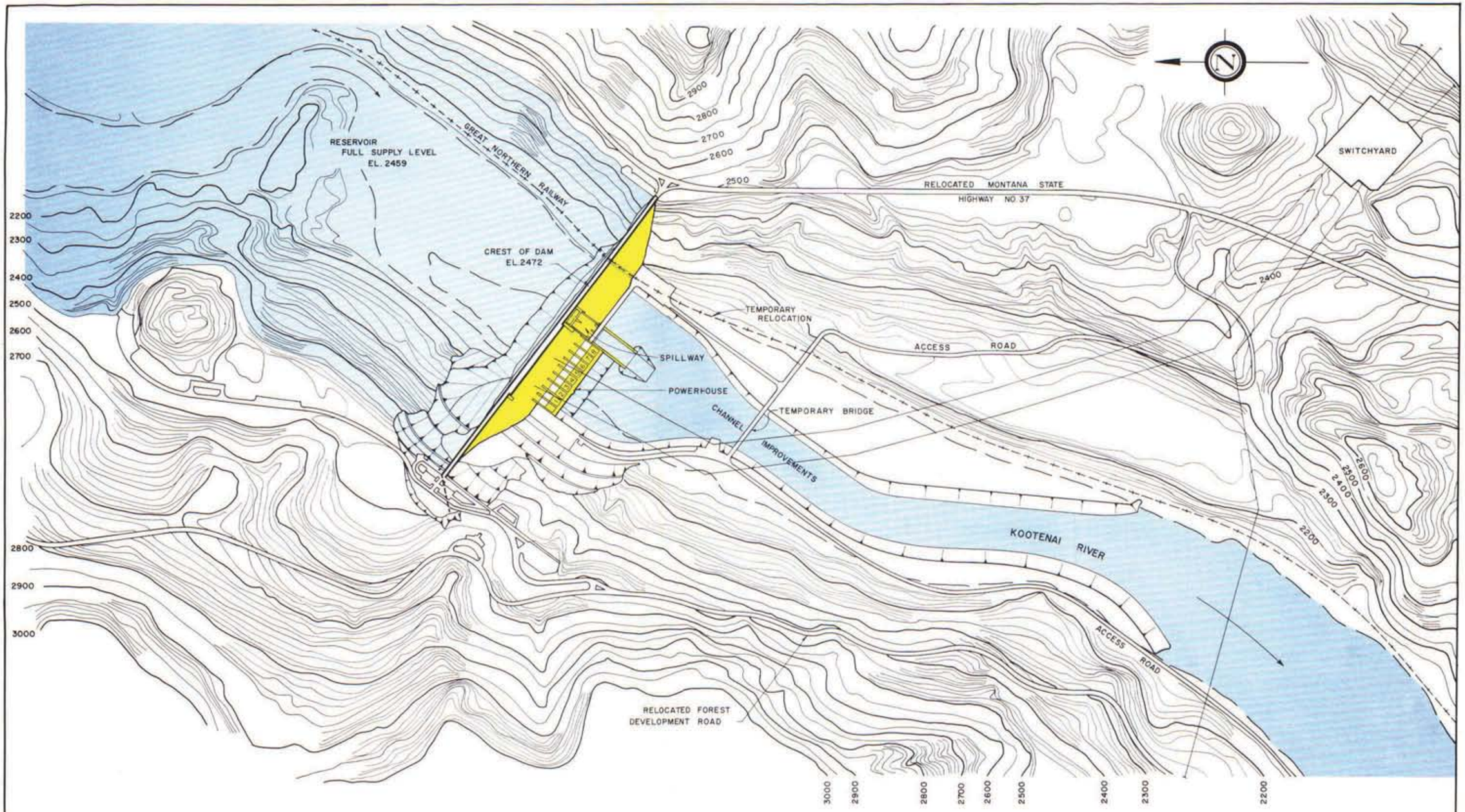
PLAN PREPARED FROM DETAILED DRAWINGS
SUPPLIED BY B.C. HYDRO & POWER AUTHORITY.

COLUMBIA RIVER TREATY
PERMANENT ENGINEERING BOARD

MICA PROJECT

GENERAL PROJECT AREA

SEPTEMBER 1969 PLATE NO. 4



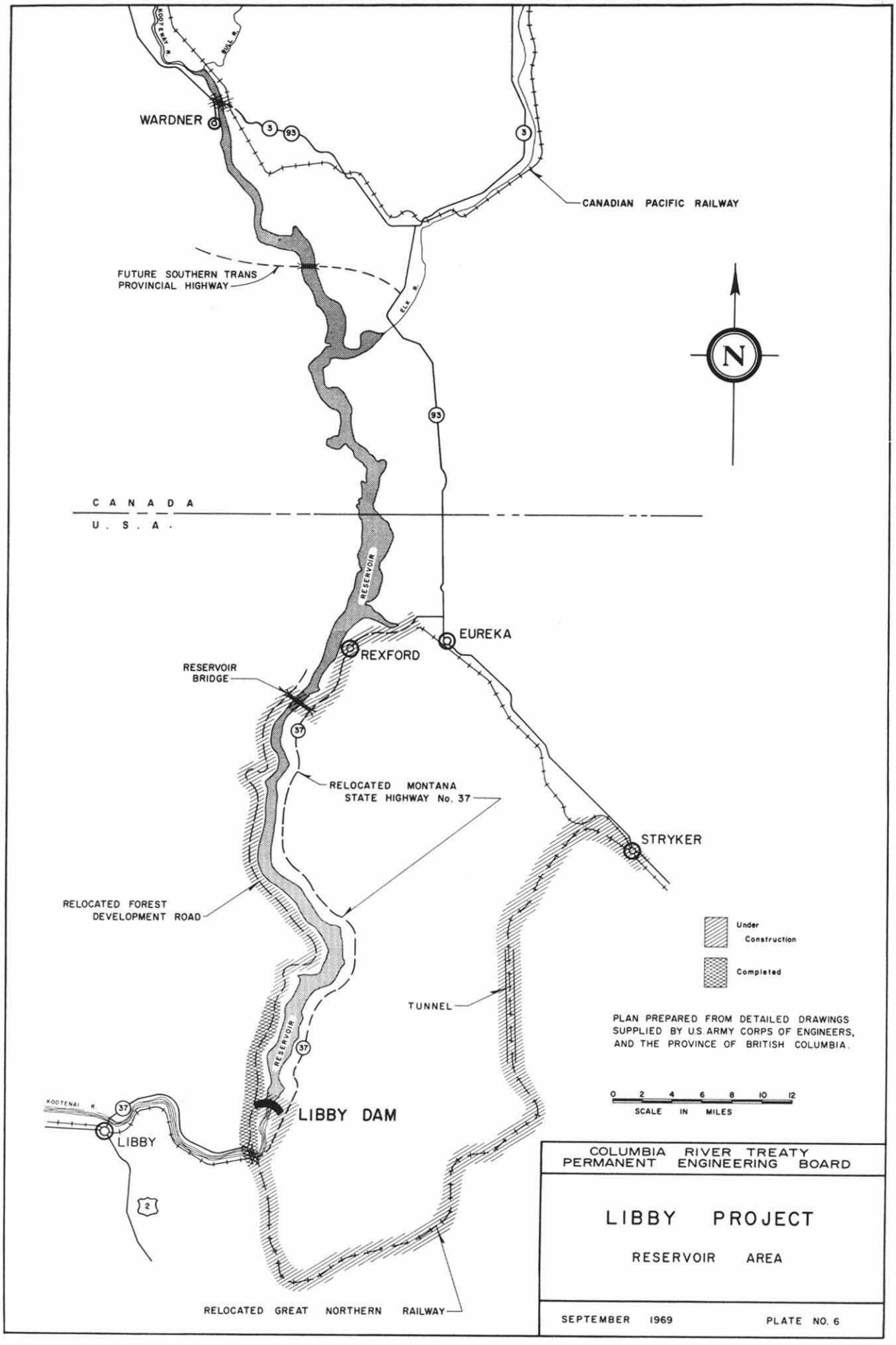
PLAN PREPARED FROM DETAILED DRAWINGS SUPPLIED BY U.S. ARMY CORPS OF ENGINEERS

COLUMBIA RIVER TREATY
PERMANENT ENGINEERING BOARD

LIBBY PROJECT

GENERAL ARRANGEMENT

SEPTEMBER 1969 PLATE NO. 5


KOOTENAI R.
BULL R.
WARDNER
3
93
3
CANADIAN PACIFIC RAILWAY
FUTURE SOUTHERN TRANS PROVINCIAL HIGHWAY
ELK R.
N
93
CANADA
U. S. A.
RESERVOIR
EUREKA
REXFORD
RESERVOIR BRIDGE
37
RELOCATED MONTANA STATE HIGHWAY No. 37
STRYKER
RELOCATED FOREST DEVELOPMENT ROAD
Under Construction
Completed
TUNNEL
RESERVOIR
37
PLAN PREPARED FROM DETAILED DRAWINGS SUPPLIED BY U.S. ARMY CORPS OF ENGINEERS, AND THE PROVINCE OF BRITISH COLUMBIA.
0 2 4 6 8 10 12
SCALE IN MILES
KOOTENAI R.
37
LIBBY DAM
LIBBY
2
RELOCATED GREAT NORTHERN RAILWAY
COLUMBIA RIVER TREATY PERMANENT ENGINEERING BOARD
LIBBY PROJECT
RESERVOIR AREA
SEPTEMBER 1969
PLATE NO. 6